Castilleja

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WHAT GOOD IS A STERILE STAMINODE?

By Peter Lesica

[*Reprinted with permission, from Kelseya, Newsletter of Montana Native Plant Society, 2002. 15(4):1,5*].

Penstemons are one of our favorite and most familiar groups of native plants. That's understandable because there are lots of them and most have colorful, showy flowers. In fact, *Penstemon* is the largest genus of plants among those found only in North America. Of the 250 species, the majority occur in the western U.S. The great diversity of penstemons makes them a great group for gardening, but it also allows us to study how flowers evolve without having to go too far from home.

Beardtongue is the common name applied to many members of the genus *Penstemon*. It refers to the fact that all penstemons have a sterile stamen called a "staminode" that is hairy to some extent in the majority of species. Penstemon flowers are pretty simple, so the staminode is easy to see. There are six slender, whitish stalks inside the corolla. Four have elongate sacs at their tips; these are the fertile stamens, and the sacs contain pollen. One of the two remaining stalks comes from the top of the ovary; this is the style that carries pollen types to the young seeds. The other sacless stalk is the staminode.

Above: *Penstemon haydenii* is among the few *Penstemon* species with both glabrous and hairy staminodes, found in mixed populations (Heidel 2005). Drawings by B. Heidel.

Evolutionary biologists believe that the pollen-bearing function of the staminode was lost during the evolution of penstemon's two-sided, two-lipped flower from more primitive, radially symmetrical tube flowers. Flowers of these less advanced groups have five functional stamens. But five doesn't divide evenly into the two halves of the bilaterally symmetrical penstemon flower, so apparently the function of one of the five stamens was lost as flowers evolved toward being two-lipped. (Continued on p. 2)

WNPS News

MEMORIAL WEEKEND ANNUAL MEETING

-Which plant species are "social" sometimes found in colonies of different species together? ..If you guessed "*BOTRYCHIUM*" *(moonworts)*, you are right!

Come join Wyoming Native Plant Society and Wyoming's social moonworts on Memorial weekend for a moonwort walk in the Black Hills. We will visit wildflowers on Warren Peak and moonworts near Upper Dugout Gulch and Williams Gulch. Meet on Saturday, May 28 @ the F.S. Reuter Campground at 9:30 am. (From Sundance, go almost 1 mile west, turn right on State Hwy 14, go almost 1 mile, turn right on FS Red 838, and go about 3.5 miles north, past a road bend at a creek crossing (see map; p. 5). The moonwort walk will be lead by visiting *Botrychium* expert of these primitive fern allies, Dr. Don Farrar.

The nearest camping is at Reuter, Sand Creek and Sundance campgrounds, and the nearest lodging is in Sundance. Questions? Call: Katherine Zacharckevics (605)-641-1707 (cell).

New Members: Please welcome the following new members to WNPS: Susan Bell (Story), Ann Belleman (Cody), Lynn Moore (Casper), and Dave Scott (Moose).

Treasurer's Report: Balance as of 22 April: General Fund $991.37; Student Scholarship Fund: $53.00; Total Funds: $1,028.87.

By-Laws Report: Vote on the three proposed By-Laws amendments (p. 8) at the 2005 annual meeting. If you do NOT attend the annual meeting on May 28 in the Black Hills, please mail your vote to WNPS by 1 June.

CELEBRATING WILDFLOWERS 2005 will take place at the Buffalo Bill Historical Center/ Draper Museum of Natural History in Cody, WY on Friday, July 8 through Sunday, July 10. The schedule of events is posted at www.bbhc.org/dmnh/index.cfm or call 578-4110 for more information.

Wyoming Native Plant Society
P.O. Box 2500, Laramie, WY 82073

WNPS Board - 2005

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Thank you Tessa Dutcher for sterling webwork!

Contributors to this issue: Beth Burkhart (BB), Bonnie Heidel (BH).

Deadline for the next issue is Sept 23; news is welcome!

Sterile Staminode (Continued from page 1)

Organs that no longer serve their primary function are called vestigial. Vestigial organs eventually meet one of two fates: they cease to be produced, or they evolve to serve a new function. ...There has been a good deal of speculation about the function of penstemon's staminode. Some researches considered it useless, while others felt it prevented nectar robbing or otherwise facilitated pollination. Recently two biologists from Calgary sought evidence for staminode function in two hummingbird and two bee-pollinated penstemons. Lawrence Harder and his student Jennifer Walker-Larsen removed the staminode in some flowers through a small slit they cut at the base of the corolla. In red, bird-pollinated penstemons there was no difference in pollination between flowers with and without a staminode. However, the bee-pollinated species were a different story. In the narrowly tubular flowers of *Penstemon ellipticus*, the staminode impeded visitng bees. They spent more time in the flower and consequently went away with more pollen on their bodies. Researchers also looked at *P. palmeri*, a species with a pouch-shaped corolla. In it, the staminode acts like a lever, causing the style to be pressed against the back of the bees when they land in the spacious flower.

The results of Walker-Larsen and Harder's study suggest that the evolution of the staminode is taking several different directions within the genus *Penstemon*, ...depending on the shape and color of the flowers.

References:
Heidel, B. 2005. Survey of *Penstemon haydenii* (Blowout Penstemon) in Wyoming – 2004. For the BLM. WYNDD, University of Wyoming, Laramie, WY.
Walker-Larsen, J. and L.D. Harder. 2001. Vestigial organs as opportunities for functional innovation: the example of the *Penstemon* staminode. Evolution 55: 477-487.

MONITORING SENSITIVE PLANT SPECIES ON THE BLACK HILLS NATIONAL FOREST

by Beth Burkhart
Botanist, Black Hills National Forest

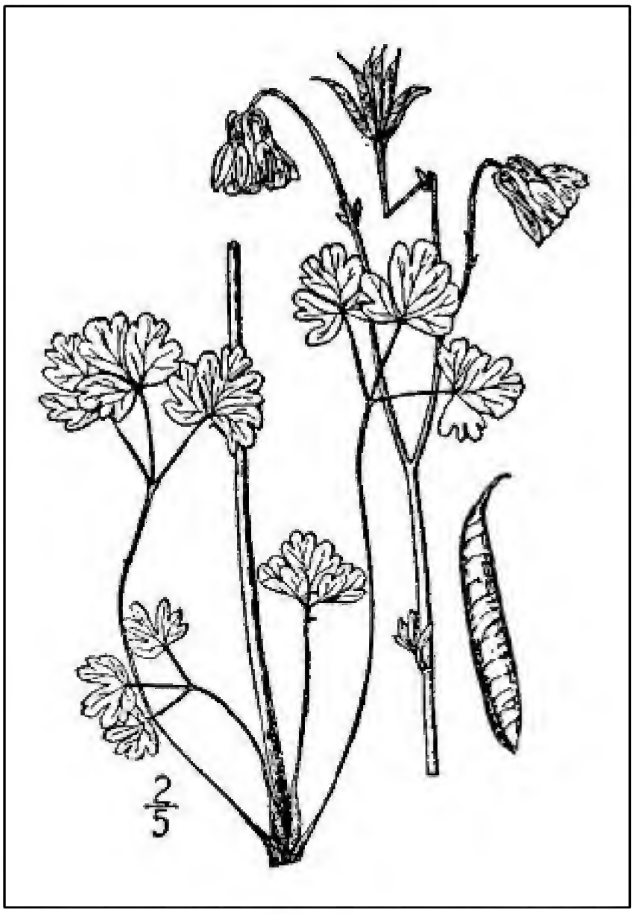
A comprehensive monitoring program for sensitive plant species has been evolving on the Black Hills National Forest since 2000. In a nutshell, the program involves adaptive monitoring of sensitive plant species (13 species as of Region 2 sensitive species list update in 2003[1]) to answer the questions:

1) Are the species persistent on the Black Hills National Forest?
2) Are they persistent in good condition, relative to individuals, the population and the habitat?

The program includes involves collecting data on four components: total occurrences/sites, individuals at selected occurrences, condition of occurrences (e.g. incidence of disease), and risks (e.g. invasive species, land use).

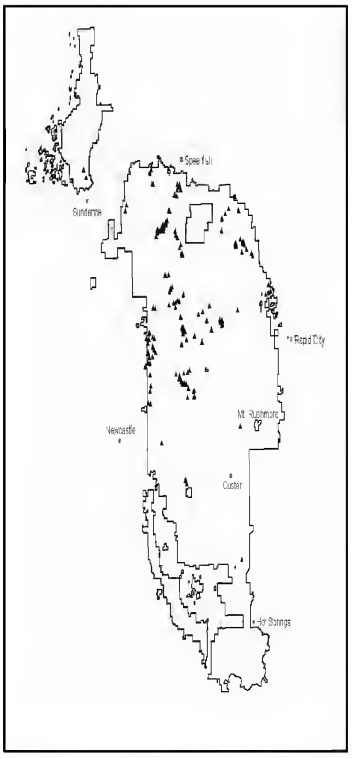
The monitoring program includes baseline inventory before a monitoring protocol is determined. However, as much as we could pretend that we fully know distribution of the species on the Black Hills (in textbooks, a given before setting up a valid monitoring protocol), the truth is that we continue to find new occurrences of most sensitive species every year. The beauty (and strength) of an adaptive program is that we give ourselves the space to admit we don't know everything and take the opportunity after every field season to incorporate new information and modify protocols as necessary.

Why does the Black Hills National Forest have a sensitive plant monitoring program? The Black Hills National Forest is primarily interested in pursuing its management activities (e.g. timber management, livestock grazing, recreation) while meeting stewardship mandates like the National Forest Management Act of 1976 and USDA Regulation 9500-004 that require the Forest Service to maintain "viable populations" of existing native and desired non-native animal, invertebrate, and plant species on the land it manages for the public.



Above: *Aquilegia brevistyla* is currently a sensitive species on Black Hills National Forest, one of two species that is documented to be more widespread than previously known (particularly in South Dakota!) as a result of survey and monitoring. In both states, it only occurs in the Black Hills. *(From: Britton, N.L., and A. Brown. 1913.* Illustrated flora of the northern states and Canada*. Vol. 2: 93. Courtesy of Kentucky Native Plant Society. Scanned by Omnitek Inc. Usage Guidelines.)*

The monitoring program provides data that allows the Forest Service to defensibly say its management activities on the Black Hills National Forest landscape are not adversely impacting sensitive species by causing a trend toward listing by the U.S. Fish and Wildlife Service as threatened or endangered. Note: I use the word "persistence" vs. "viability" except when quoting or paraphrasing laws, regulations, and policy. Given how little we know about plant species regarding their genetic framework, reproductive modes, demographic characteristics, etc., it's really not possible to defend statements on species viability. While understanding species viability may be the goal, the best we can do is discuss persistence.



Left: Distribution of *Aquilegia brevistyla* on on the Black Hills National Forest; documented in presence/absence monitoring (map courtesy of BHNF)

Fortunately, we are able to fulfill multiple purposes with information generated from the Black Hills National Forest monitoring program. Besides filling the Forest Service need to manage for multiple use while maintaining sensitive species on the forest, the monitoring program also contributes to botany science (all occurrence information for sensitive information is submitted to WYNDD and the SD Natural Heritage Program annually; other species of interest are also documented and reported in the course of sensitive species work; vouchers for each occurrence of a sensitive species as well as any new records are submitted to the Rocky Mountain Herbarium, home of Forest Service herbarium of record in Region 2). The monitoring program also provides information to allow appropriate updating of the Region 2 sensitive species list and contributes to other region-wide species conservation projects. In addition, it helps build credibility and provides a forum for communication with the public.

So what's the structure of the Black Hills National Forest monitoring program? While it may appear too simple, a short outline covers all the steps:

1) collect baseline data,
2) evaluate baseline data and develop monitoring questions – in consultation with the Forest Service's Rocky Mountain Research Station,
3) develop protocols,
4) apply protocols,
5) evaluate protocols and adaptively modify as necessary to answer monitoring questions – in consultation with the Rocky Mountain Research Station.

Where complication enters in is that each sensitive plant species is unique – from biological aspects to autecological aspects to habitat aspects. In addition, our knowledge of all these aspects is incomplete. So each species requires individual review and protocol development, and then individual analysis to determine if the data being generated is applicable. Another major complication that all field botanists know and love is the challenge of actually applying the protocols. There are always unexpected stumbling blocks with access issues, getting to sometimes out-of-the-way occurrence locations, weather surprises, etc. But that's the fun stuff!

A short case-study example of a specific species and monitoring protocol may help the reader understand the monitoring program, including its adaptive characteristics. *Salix serissima* (autumn willow) had only 2 occurrences known from the Black Hills until 2004, and only 1 is of large size in highly suitable habitat (McIntosh Fen). The starting protocol in 2001 developed by the forest monitoring team in consultation with the Rocky Mountain Research Station (Carolyn Sieg and Rudy King) for the occurrence at McIntosh Fen included: 1) GPS endpoints of the site; 2) count individuals during the blooming period; if the number of individuals declines by more than 10%, consult with the Rocky Mountain Research Station on a more rigorous design; 3) take annual water measurements from piezometers installed in 2001; and 4) document any noxious weeds.

Here's a summary of the census data from the large site:

2001 – 453 individuals
2002 – 560 individuals
2003 – 764 individuals
2004 – 462 individuals

The reader can easily see that the drop from 764 individuals in 2003 to 462 individuals in 2004 tripped the trigger for a decline of more than 10%. In discussion of the data at the fall/winter 2004 meeting of the Black Hills National Forest plant monitoring team and Rocky Mountain Research Station, the field botanists did not report a large number of dead individuals or clumps as would be expected if mortality were the reason behind the decline! The main problems that surfaced were inaccurate identification and inconsistency determining individuals vs. clumps, exacerbated by the high number counts.

The protocol for *Salix serissima* at McIntosh Fen was adaptively modified based on this new information to include: 1) GPS endpoints of 2 subpopulation boundaries that have been delineated after gaining greater familiarity with the occurrence; 2) establish permanent markers along the boundaries (a minimum of 10) and assess the condition/vigor or the 5 closest individuals/clumps, including rust infection; 3) take annual surface water measurements along two transects established in 2004 and establish a third transect to add to the protocol for annual measurement; and 4) document any noxious weeds or other invasive species and note whether weeds are co-located with *S. serissima* or at what distance the weeds are located from the occurrence (if occupying the same ecological type). This new, revised protocol should provide data to answer our monitoring questions more accurately and reliably, with less impact to the species. It's also the new foundation from which to learn and to incorporate new information into as generated in the future!

One last, critical component of the Black Hills National Forest sensitive plant monitoring program is a prioritization strategy. It hasn't happened so far, but it may come to pass that it will be impossible in a given summer to complete all the monitoring and baseline data collection set out in the annual monitoring plan. Anything from employee turnover to an extreme fire summer could be a major factor. So the Black Hills National Forest plant monitoring group developed a prioritization strategy based on items including risks, total number of individuals known, occurrence locations, "clumpiness" of sites (adjacent vs. widespread), and monitoring or survey cost. Each sensitive species is ranked as high, medium, or low priority (example of high priority: relatively few occurrences, limited habitat, limited distribution on forest – *Epipactis gigantea* (stream orchid); example of low priority: large number of occurrences and low risks OR few occurrences and difficult to find and identify; habitat abundant or not quantifiable – *Carex alopecoidea* (foxtail sedge) OR *Botrychium campestre* (Iowa moonwort). If it becomes apparent that the full monitoring/baseline data collection scope can't be completed, the prioritization strategy will come into play to guide choices on what to do first and what to let go.

The Black Hills National Forest sensitive plant monitoring program is unique in forests of Region 2. The reasons behind this are complex and include the political history of the Black Hills National Forest in appeals and litigation. The program has served the forest well in getting a handle on distribution and persistence of sensitive species and providing good contributions to the scientific information base. It also keeps us humble – the more we learn, the more we appreciate how much there is to still be learned about being responsible vegetation managers of our public land!

Acknowledgements:
Thanks to the team of botanists who worked hard from 2000 to 2004 to get the Black Hills National Forest sensitive plant monitoring program up and running: Darcy Bacon, J. Hope Hornbeck, and Reed Crook, under the leadership of Deanna Reyher, Black Hills National Forest Ecologist.

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The annual Black Hills National Forest Monitoring Report (results) and Monitoring Guide (protocols) are available on the world-wide web at:
//www.fs.fed.us/r2/blackhills/projects/planning/index/shtml
The R2 sensitive species are posted at:
//www.fs.fed.us/r2/projects/scp/sensitivespecies/index.shtml.
Note: revision of R2 sensitive species list is underway; expect formal notice of changes in May 2005. Most likely changes affecting Black Hills National Forest are for *Aquilegia brevistyla* and *Carex leptalea* to no longer retain sensitive designation.

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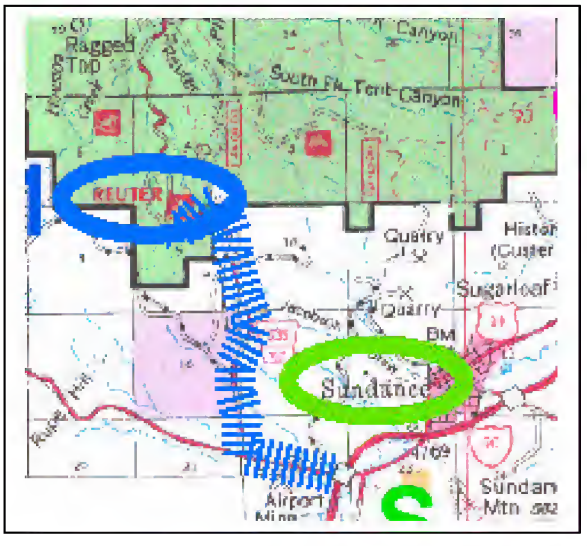
COME DO THE BLACK HILLS MOONWORT WALK!
Meet May 28, 9:30 am, @ Reuters C.G., nw of Sundance



Plant Monitoring in Wyoming

By Bonnie Heidel

Who are the real trend-setters in the Wyoming botany community? ...Why, the plants! But trend information is hard to come by. Monitoring is conducted when trend information is needed beyond one-time numbers of plant populations and population sizes.

Wyoming has 488 rare vascular plant species of concern and over 3000 records of rare plant populations, so any consideration of monitoring also needs to consider priorities and objectives. For many species, there has not been systematic survey, which usually occurs before monitoring priorities are set. For many surveyed species, there were not immediate threats because of habitat remoteness, and monitoring was not pursued. In a small number of cases, monitoring was initiated (31 species) and is still pursued in Wyoming for 15 species (as indicated by 2004 monitoring activity; see table, below). Tabulations of monitoring results and any other revisit information are incorporated in each rare plant occurrence record in the state. A highlight of salient monitoring results does not take the place of an establishment report or monitoring protocol that states precisely what is being monitored, where, by what methods, and for what objectives. A synthesis of trend records, observations, and inferences are highlighted in the "trend" column on the Wyoming species of concern list (in Keinath et al. 2003) and described in state plant species abstracts (posted at: www.uwyo.edu/wyndd/ ; go to "plants", "species of concern list", and then for each species, select "state species abstract"), referring to population size, numbers of populations, or the area of occupancy.

The single largest group of species that are monitored in Wyoming are the sensitive species on Black Hills National Forest. The Black Hills National Forest monitoring program is described by Beth Burkhart (pp. 3-5, this issue). The single longest species monitoring project is monitoring of Colorado butterfly plant (*Gaura neomexicana* ssp. *coloradensis*) for 17 consecutive years on F.E. Warren Air Force Base, an intensive monitoring project conducted by a host of researchers.

There are three levels of monitoring that document changes in population persistence (presence/absence), population size (census), or population structure (demographics); (Elzinga et al. 1998, Menges and Gordon 1996). Monitoring can be designed as baseline monitoring under *status quo* conditions, or as management response monitoring. A couple monitoring projects have been developed to evaluate trends under potential threats. Most other monitoring in Wyoming has been baseline monitoring, except for an opportunistic follow-up when a wildfire burned through one of the baseline monitoring plots or when other unplanned disturbances happened on a smaller scale. In addition, monitoring can be part of a detection program for noxious weeds, as it is in the Black Hills. Monitoring projects may provide information on species biology, population biology and threats, too. The monitoring articles in this issue are a springboard for discussion and for future articles on the agony and ecstasy of monitoring plant populations. An overview of plant species monitoring activity in Wyoming is presented in Table 1 (next page).

Addition to the Flora of Wyoming

A newly-described variety of rabbitbrush, *Ericameria discoidea* (Nutt.) Nesom var. *winwardii* Dorn & Delmatier was published in Madroño last March, only known from Lincoln Co., Wyoming and adjoining Bear Lake County, Idaho. It is a short-stature shrub (0.5-2 dm high) of foothills and basin that is also disjunct and at lower elevations compared to the other two varieties *(E. d.* var. *discoidea* and *E. d.* var. *linearis*). It has leaves that are flat and intermediate in shape between the other two varieties, distinctly floccose-tomoentose and eglandular. (It is also added to the Wyoming species of concern list.)

Reference

Dorn, R.D. and C. H. Delmatier. 2005. A new variety of *Ericameria discoidea* (Asteraceae) from Idaho and Wyoming. Madroño, Vol 52:63-65

Table 1. Plant species monitoring in Wyoming

Species	Level	Scope[2]	Establishment report/ protocol	Re-read	Final report
Abronia ammophila	census	All 4 sites		Once	
Antennaria arcuata	demogr	2 sites	Fertig 1996	-	
Aquilegia brevistyla	pres/absence	All in BHNF		Annual	
Artemisia porteri	demogr	3 sites	Fertig 2001	-	
Astragalus proimanthus	demogr	1 site	Fertig 2001	-	
Botrychium lineare	census	All in BHNF		Annual	
Botrychium multifidum	census	All in BHNF		Annual	
Carex alopecoidea	census	All in BHNF		Annual	
Carex leptalea	pres/absence	All in BHNF		Annual	
Cirsium aridum	demogr	All in BHNF	Fertig 1995	-	
Cirsium ownbeyi	demogr	2 sites	Fertig 1999	-	
Cymopteris evertii	demogr	3 sites	Fertig et al. 1999	Once, post-fire	Heidel 2002
Cypripedium parviflorum	pres/absence	All in BHNF		Annual	
*Epipactis gigantea**	census	All in BHNF		Annual	
Gaura neomexicana ssp coloradensis	census, demogr	1 site	Lichvar & Dorn 1984 Marriott 1986, Floyd 1995	Annual	Heidel 2005 Floyd & Ranker 1998
Lesquerella fremontii	demogr	1 site	Fertig 1995	-	
Lesquerella macrocarpa	demogr	1 site	Fertig 1995	-	
Lycopodium complanatum	census	All in BHNF		Annual	
Penstemon acaulis	demogr	1 site	Fertig 2001	-	
Penstemon caryi	demogr	1 site	Fertig 2001	-	
Penstemon gibbensii	demogr	1 site	Fertig 1996	~ Annual	
Penstemon haydenii	demogr, census	All 3 sites	Heidel 2005	Annual	Heidel 2005
Physaria dornii	demogr	1 site	Fertig 1998	-	
Platanthera orbiculata	census	All in BHNF		Annual	
Rubus acaulis	census	1 site	Fertig 2000	Once	
*Salix candida**	census	All in BHNF		Annual	
*Salix serissima**	census	All in BHNF		Annual	
*Sanguinaria canadensis**	census	All in BHNF		Annual	
Spiranthes diluvialis	census	2 sites		~ Annual	
Sullivantia hapemanii	census	1 site	Humphrey	Periodic	Humphrey
Thelesperma caespitosum	demogr	1 site	Fertig 1995	-	
Thelesperma pubescens	census	3 sites	Marriott 1988	Once	Heidel 2004
Townsendia microcephala	demogr	1 site	Fertig 1995	-	
Viburnum opulus var. americanus	pres/absence	All in BHNF		Annual	
*Viola selkirki**	census	All in BHNF		Annual	
Yermo xanthocephalus	census	The 1 site	Scott 2000	Annual	

Partial list of references cited

Elzinga, C.L., D.W. Salazer and J.W. Willoughby. 1998. Measuring and Monitoring Plant Populations. BLM Technical Reference 1730-1. Copies available from: BLM National Business Center. BC-650B, P.O. Box 2504, Denver, CO 80225-0047. 477 pp.

Menges, E.S. and D.R. Gordon. 1996. Three levels of monitoring intensity for rare plant species. Nat. Areas J. 16(3):227-237.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Proposed By-Laws Amendments

The following will be voted on at the Annual Meeting. Any mail-in votes must be sent to WNPS and postmarked by 1 July.

Vote 1. Membership. Add: "...AND A LIFE MEMBERSHIP CATEGORY IS AT $200. ALL OTHER MEMBERSHIPS WILL FOLLOW THE CALENDAR YEAR.

_____Yes _____No

Vote 2. Board of Directors meeting. Add: "...OR CONDUCT BUSINESS BY EMAIL." Add: ALL BOARD ACTIONS WILL BE REPORTED IN THE NEWSLETTER.

_____Yes _____No

Vote 3. Amendments to the By-Laws. Add: "...that members in good standing shall have the power to amend the By-laws of the Society at the annual meeting OR BY MAIL. Amendments shall be announced in the notice for that meeting OR IN ADVANCE OF THE MAIL VOTE.

_____Yes _____No

Wyoming Native Plant Society
P.O. Box 2500
Laramie, WY 82073

The Wyoming Native Plant Society, established in 1981, is a non-profit organization dedicated to encouraging the appreciation and conservation of the native flora and plant communities of Wyoming. The Society promotes education and research on native plants of the state through its newsletter, field trips, and annual student scholarship award. Membership is open to individuals, families, or organizations with an interest in Wyoming's flora. Members receive *Castilleja*, the Society's quarterly newsletter, and may take part in all of the Society's programs and projects, including the annual meeting/field trip held each summer. Dues are $7.50 annually. To join or renew, return this form to:

Wyoming Native Plant Society
P.O. Box 2500
Laramie, WY 82073

Name: _____

Address: _____

_____

Email: _____

___ $7.50 Regular Membership
___ $15.00 Scholarship Supporting Member
($7.50 goes to the annual scholarship fund)